An input-output approach in assessing the CAP reform impact of extensive versus intensive farming systems on rural development: the case of Greece

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Abstract

This paper analyses the role of the extensive versus the intensive farming systems in the regional economy of a Greek rural area, Trikala, and assesses the impact of the shift of land resources from intensive to extensive systems, due to CAP reform. The construction of an input-output table through the GRIT technique is applied for (a) an agriculture-centred multiplier analysis of the farming systems and (b) an impact analysis of the changes in farm land uses on the regional economy, by exogenizing the output of the agricultural farming systems. The results indicate a reduction in the output of the region's economy.

Key words: *intensive vs extensive farming systems; CAP reform, rural development; input-output analysis*

Introduction

In the Mid-term review of the CAP (2003/2004), the EU took a step towards strengthening the multifunctional role of agriculture by implementing "decoupling", "modulation" and "cross-compliance". In the same period, environmental protection and land management has become a key policy objective (Axis 2) of the EU rural development policy. These significant changes have introduced reallocation of land resources from intensive to extensive farming systems and have initiated restructuring in agriculture and in rural areas.

Under these circumstances, the analysis of the impact of extensive vs intensive farming systems on the development of rural areas should identify: (a) the farming systems which create the strongest backward linkages with the other sectors of the economy and contribute to the economic development of the area; and (b) how farm land reallocation from intensive to extensive crops, due to CAP reform, affects the total output of the regional economy.

In order to fulfill these objectives, this paper focuses on the application of the input-output technique, with particular attention to the role of different farming systems in the rural economy, through final demand multiplier analysis. Often however, agricultural policies or other external factors induce exogenous changes in sectors' output which do not relate to final demand changes. In such cases, as the change in the mix of farming systems described here, it is essential to transfer the relevant exogenous changes on the

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sectors' output in order to measure the impact on the rest of the economy.

This analysis is carried out for the Greek study area of Trikala, a NUTS III-level area and "predominantly rural" according to OECD classification (OECD, 1994), located in the central part of Greece, with an area of 3.384 km2 and population 138.047 inhabitants. Trikala depends heavily on agriculture as agricultural employment accounts to 30% of the total employment and contributes by 15% to GDP formation. Its agricultural utilized land (60.000 ha, of which 70% irrigated) allows the presence of both intensive farming systems of irrigated crops such as cotton, maize, sugarbeets etc. and of extensive farming systems of cereals, while in the mountainous areas extensive livestock farming of sheep-grazing prevails. Any CAP change that stimulates shifts of agricultural land from intensive to extensive farming is expected to affect the regional economy of Trikala, due to agriculture's role in it.

Methodological aspects of the input-output analysis

Input-output multiplier analysis

Input-output analysis is recognized as the most suitable quantitative technique for studying the interdependence of production sectors in an economy and identifying major sectors and financial flows between them, over a stated time period (usually a year). Within a macroeconomic framework, input-output modeling can be used for structural analysis, technical change analysis and forecasting. However, the most popular application of the I-O technique is impact analysis and policy evaluation with respect to national or regional goals such as employment, GDP and balance of trade. The I/O model is used to estimate direct and indirect effects on related sectors and on the whole economy, resulting from increased demand for the output of one or more sectors. These effects are quantified by Type 1 output, income and employment multipliers, which express the ratio of total effect to the initial change in demand.

$$Type\ 1\ multiplier\ =\ \frac{Direct\ and\ indirect\ effects}{Direct\ effects}$$

Further economic activity, stimulated by increased household spending is termed the induce effect and is incorporated in the Type 2 multipliers:

$$Type\ 2\ multiplier\ =\ \frac{Direct,\ indirect\ and\ induced\ effects}{Direct\ effects}$$

With respect to the construction of a regional I/O table the various approaches can be broadly categorized as 'survey', 'non-survey' and 'hybrid' (Richardson 1972). The 'survey' approach relies on collecting primary data through various survey methods. The advantage of this approach is that it does not assume similarity between regional and national production functions. The 'non-survey' approach involves the representation of the regional economy through the modification of national technical coefficients. However, the 'non-survey' methods do not provide satisfactory substitutes for the 'survey' approach as the constructed regional tables are not free from significant error

(Richardson, 1972). In response to this problem, a 'hybrid' approach involves the application of 'non-survey' techniques to estimate an initial regional transactions matrix. Then, entries in this matrix relating to key sectors are replaced by survey-based estimates. One of the most well-known hybrid techniques is GRIT (Generation of Regional Input-Output Tables).

The GRIT approach

The GRIT technique was developed and originally applied by Jensen *et al* (1979) and later used by Johns and Leat (1987), Psaltopoulos and Thomson (1993), Tzouvelekas and Mattas (1999) and Ciobanu *et al*. (2004). According to Jensen *et al*. (1979), GRIT system was developed '…to provide an operational method, free from significant error, for regional economic analysis'. A mechanical procedure is initially applied to adjust national tables by using an employment-based Cross Industry Location Quotient (CILQ) or Simple Location Quotient (SLQ) to the corresponding elements of the national direct requirement matrix, followed by the insertion of 'superior' data from survey or other sources. As a result, GRIT includes the advantages of both 'survey' and 'non-survey' techniques.

Application of I/O analysis in the evaluation of agriculture's role in the economy

A number of studies, employing input-output analysis, appeared in the literature dealing with the estimation of agriculture's economic role and impact on national or regional level. Henry and Schulder (1985) by measuring the backward and forward linkages of food and fiber sector in USA, stress the importance of agriculture. Tzouvelekas and Mattas (1999) examine the role of agro-food sector in the local economy of the Greek island Crete. The collective volume of Midmore and Harrison-Mayfield (1996), presents a number of studies examining the role of agriculture in an economy by utilizing I-O analysis, while Baumol and Wolff (1994) in their study stress the significance of indirect effects of agriculture in the economy. Mattas and Tsakiridou (2010) stress the determinant role of food industry in the economy of Europe especially at recession time indicating its high output and employment multipliers. However, very little analysis has actually taken place on disaggregated farming systems and on their impact on the overall economy of rural areas, a priority area in the CAP policy agenda.

Theoretical aspects of exogenizing sectoral outputs

Input-output analysis implicitly assumes that all endogenous sectors can produce any level of output required to meet final demands. Given this assumption, changes in the elements of final demand can be introduced to the input-output model and through the calculation of final demand input-output multipliers as presented above, total effects on each sector can be measured. Often however, policies or uncontrollable factors induce exogenous changes in total outputs of sectors and commodities making the use of final demand multipliers biased (Papadas and Dahl, 1999).

Attempts to resolve the problem include the development of an iterative linear programming solution applied to the input-output model as one method of handling exogenous constraints on sectoral outputs, which are predetermined rather than simultaneously determined by final and intermediate demand (Petkovich and Ching, 1978). To accommodate these constraints, Johnson and Kulshreshtha (1982) propose a procedure within input-output framework which leads to a new set of multipliers which Papadas and Dahl (1999) call "supply-driven" for obvious reasons. Their usefuleness for impact analysis of specific exogenous changes in total outputs is widely recognized and they can also be used to assess the output effects of economic phenomena by translating accurately these phenomena into output changes. The procedure of Johnson and Kulshreshtha (1982) to exogenise a given set of outputs is described here. The basic equation of input-output analysis is:

$$X = AX + F \tag{1}$$

Using subscript 1 to denote the sectors whose outputs are to be exogenised and subscript 2 for the rest, with matrix partitioning (1) can become:

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} M_{11} & M_{12} \\ M_{21} & M_{22} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} F_1 \\ F_2 \end{bmatrix} \tag{2}$$

which represents a system of two matrix equations. The unknowns now are X2 and F1 while X1 and F2 are exogenously determined. Solving the second equation yields:

$$X_2 = (I - M_{22})^{-1}(M_{21}X_1 + F_2) \tag{3}$$

Given the levels of X1 and F2 (or their change), the level of X2 (or its change) can be estimated from (3). Inserting this value in the first equation of the system gives the new value of F1 or its change:

$$F_1 = (I - M_{11})X_1 - M_{12}X_2 \tag{4}$$

If the interest is only in the impact of exogenous changes in outputs, on other outputs, one can assume the change in F2 to be zero and the suggested multipliers matrix from (3) is

$$(I - M_{22})^{-1}M_{21} \tag{5}$$

If k sectors are exogenised, the matrix is of dimension (m-k, k) and the ijth element shows the change in sector i's output due to a unitary change in sector j's output.

Analysis and Results

The construction of the Trikala I/O table

The construction of the Trikala I/O table was based on the 2000 commodity by commodity national I/O table, which included 59 sectors of economic activity (groups of products). This table was updated to 2004 with the application of the RAS method and aggregated into 18 sectors.

For the construction of the regional I/O table the GRIT method was adopted, which utilizes sectoral employment data and information extracted from surveys on selected sectors of the local economy. The selection of the sampled sectors was based on two criteria: (a) the significance of these sectors for the regional economy and (b) the existence of strong intersectoral linkages with the agricultural sector (Czamanski and Malizia, 1969). These were agriculture, food manufacturing, trade and tourism. In the construction of Trikala's I/O table, agriculture was disaggregated into four farming systems: extensive arable crops, extensive livestock, intensive arable crops and other agricultural system. In total the final I/O table of Trikala consists of 21 sectors.

Output multipliers

Based on the constructed I/O table for Trikala, Table 1 indicates the Type 1 output multipliers which express the regional significance of the backward linkages of each sector. The multiplier for the farming system of intensive crops is amongst the highest (3rd in rank), while for the farming system extensive arable is relatively low, indicating weak linkages with other sectors. So, a unit increase in the final demand for the products of the intensive crops farming system (i.e., exports, consumption or investments) will increase the total (direct and indirect) output in the region of Trikala by 1,653 units. The highest backward linkages amongst the non-agricultural sectors are created by the products of the sector of trade (1,78) followed by the sector of metal products (1,66) and tourism (1,573).

Table 1 – Output multipliers for Trikala (2004)

Sectors of economic activity	Type 1	Rank	Type 2	Rank
Extensive arable	1,444	10	2,163	13
Extensive livestock	1,548	6	2,679	4
Intensive arable	1,653	3	2,566	7
Other agr system	1,634	4	3,251	3
Mining	1,157	20	1,646	20
Food manufacture	1,298	16	1,683	19
Textile	1,524	7	2,181	11
Wood and paper	1,457	9	2,181	12
Chemical and plastic products	1,484	8	1,913	18
Non metal products	1,430	12	2,252	10
Metal products	1,660	2	2,288	9
Machinery and equipment	1,197	19	1,550	21
Electricity, gas and water	1,204	18	1,941	16
Construction	1,433	11	2,113	14
Trade	1,780	1	2,540	8
Tourism	1,573	5	2,097	15
Transportation	1,396	13	2,587	6
Banking-Financing	1,360	14	1,932	17
Public administration	1,344	15	3,561	1
Education	1,062	21	3,538	2
Other services	1,257	17	2,643	5

The largest induced effects (Type 2 output multipliers) tend to be in the farming systems of other agr. system (3,251 – 3rd in rank) and extensive livestock (2,679 – 4rth in rank). This is because wages and salaries represent a large proportion of their total inputs. Multiplier for the farming system of extensive arable is not amongst the highest, albeit not low. The highest induced effects amongst the non-agricultural sectors are created by the products of the sectors of public administration (3,561), education (3,538) and other services (2,643).

Income coefficients and multipliers

Table 2 shows income coefficients and multipliers. Income coefficients indicate the total increase in incomes generated by a unit increase in the output of the products of a particular sector. Direct income coefficients (DICs) for other agr. system and extensive livestock are amongst the highest, while capital-intensive sectors such as trade, chemical and plastic products and food manufacture have low coefficients. Type 1 income multipliers for the farming systems are rather low with the highest appearing to the farming system of extensive arable (1,599 – 5th in rank) and intensive arable (1,485 – 7th in rank). The Type 2 multipliers follow the same pattern as the Type 1 multipliers.

Table 2 - Income coefficients & multipliers for Trikala (2004)

Sectors of economic activity	Direct Income Coefficient	Direct & Indirect Income Coefficient	Type 1 Income Multiplier	Direct, Indirect & Induced Income Coefficient	Type 2 Income Multiplier
Extensive arable	0,139	0,223	1,599	0,291	2,092
Extensive livestock	0,265	0,351	1,324	0,459	1,732
Intensive arable	0,191	0,283	1,485	0,370	1,943
Other agr system	0,400	0,501	1,254	0,656	1,640
Mining	0,131	0,152	1,161	0,198	1,518
Food manufacture	0,085	0,119	1,400	0,156	1,831
Textile	0,133	0,204	1,529	0,266	2,000
Wood and paper	0,159	0,224	1,412	0,293	1,847
Chemical and plastic products	0,074	0,133	1,788	0,174	2,339
Non metal products	0,191	0,255	1,335	0,333	1,746
Metal products	0,112	0,194	1,738	0,254	2,273
Machinery and equipment	0,086	0,110	1,270	0,143	1,662
Electricity, gas and water	0,199	0,228	1,147	0,299	1,501
Construction	0,151	0,211	1,396	0,276	1,826
Trade	0,066	0,235	3,563	0,308	4,661
Tourism	0,085	0,162	1,918	0,212	2,508
Transportation	0,303	0,369	1,219	0,483	1,594
Banking-Financing	0,124	0,177	1,425	0,232	1,864
Public administration	0,637	0,687	1,078	0,899	1,410
Education	0,757	0,767	1,014	1,004	1,326
Other services	0,384	0,430	1,118	0,562	1,462

Employment coefficients and multipliers

The employment coefficients and multipliers are shown in Table 3. The farming systems are more labour-intensive compared to other sectors and therefore they have high direct employment coefficients. An additional 1 million euro of output for the products of extensive livestock and intensive arable farming systems create 44 and 36 jobs respectively, in contrast to tourism (14) and food manufacture (6). Type 1 employment multipliers indicate weak backward effects for the farming systems. Amongst them the highest Type 1 employment multiplier (1,581) belongs to the products of extensive arable crops, due to lower direct employment effects of this farming system compared to other farming systems. The linkages are significant for the products of trade (2,921) and chemical and plastic products (2,029). Direct, indirect and induced coefficients indicate the total effect of increased output on employment. The total number of jobs created in extensive livestock (68 – 1st in rank), other agr system (63 – 3rd in rank) and intensive arable (58 – 4th in rank) by increasing output in each is very high.

Table 3 - Employment coefficients & multipliers for Trikala (2004)

Sectors of economic activity	**Direct Employment Coefficient**	**Direct & Indirect Employment Coefficient**	**Type 1 Employment Multiplier**	**Direct, Indirect & Induced Employment Coefficient**	**Type 2 Employment Coefficient**
Extensive arable	22	35	1.581	42	1.899
Extensive livestock	44	57	1.306	68	1.559
Intensive arable	36	49	1.368	58	1.619
Other agr system	34	47	1.361	63	1.821
Mining	4	5	1.459	10	2.776
Food manufacture	6	9	1.627	13	2.306
Textile	10	16	1.582	23	2.201
Wood and paper	15	22	1.450	29	1.921
Chemical and plastic products	3	7	2.029	11	3.238
Non metal products	9	14	1.530	22	2.406
Metal products	10	17	1.741	23	2.385
Machinery and equipment	6	8	1.361	11	1.954
Electricity, gas and water	6	8	1.363	15	2.604
Construction	18	24	1.287	30	1.648
Trade	13	38	2.921	45	3.497
Tourism	14	22	1.610	27	1.982
Transportation	20	26	1.283	38	1.855
Banking-Financing	10	15	1.451	20	1.997
Public administration	26	30	1.156	52	1.984
Education	38	39	1.022	63	1.662
Other services	27	30	1.135	44	1.646

Farming systems 'supply-driven' multipliers

To assess the impact of the farming systems on the local economy from the supply side, it is necessary to exogenize the output of the farming systems based on the methodology described above in paragraph 2.4. In Table 4, 'supply-driven' multipliers of each farming system for the rest sectors of economy are presented. Each element shows the output change of the ith sector due to the exogenous change of the output of the corresponding farming system. The sum of the column's elements shows the total impact of the exogenous change of the output of the different farming systems by one unit on the local economy's output. In other words, if the output of intensive arable system increases by 1 million euro, the output of the other sectors of local economy will increase by 0,5381 million euro. Extensive arable farming system creates a lower impact on the local economy (0,4256) compared to the intensive one (0,5381). It is noted that the other agr. system appears to have a rather high multiplier (0,5568).

Table 4 - 'Supply-driven' multipliers of different farming systems to the local economy

Sectors of economic activity	**Extensive arable**	**Extensive livestock**	**Intensive arable**	**Other agr system**
Extensive arable	-	0,0541	0,0000	0,0108
Extensive livestock	0,1935	-	0,0002	0,0839
Intensive arable	0,0373	0,1601	-	0,0383
Other agr system	0,0087	0,0107	0,0003	-
Mining	0,0012	0,0019	0,0073	0,0039
Food manufacture	0,0002	0,0002	0,0045	0,0003
Textile	0,0001	0,0001	0,0023	0,0002
Wood and paper	0,0014	0,0017	0,0135	0,0029
Chemical and plastic products	0,0028	0,0032	0,0115	0,0063
Non metal products	0,0001	0,0001	0,0289	0,0002
Metal products	0,0003	0,0004	0,0262	0,0008
Machinery and equipment	0,0021	0,0025	0,0138	0,0047
Electricity, gas and water	0,0200	0,0364	0,0380	0,0770
Construction	0,0006	0,0007	0,0018	0,0019
Trade	0,1406	0,1728	0,3543	0,2755
Tourism	0,0002	0,0002	0,0005	0,0005
Transportation	0,0122	0,0069	0,0239	0,0238
Banking-Financing	0,0034	0,0020	0,0105	0,0236
Public administration	0,0000	0,0000	0,0000	0,0000
Education	0,0000	0,0000	0,0000	0,0000
Other services	0,0010	0,0010	0,0006	0,0020
Total	**0,4256**	**0,4550**	**0,5381**	**0,5568**

Impact assessment of farm land reallocation due to the CAP reform

The implementation of the CAP reform (2003-2004) has resulted in changes in the agricultural sector of the prefecture Trikala as well as at national level. The overwhelming bulk of production-linked subsidies have been replaced by the Single Farm Payment (SFP), which does not require specific farm output or even specific farm input use. Specifically, in Trikala, upon the initiation of the CAP reform and between 2004-2007, 3.850 hectares were moved from intensive arable to extensive arable crops representing 12% of the intensive cropping land. This reallocation of land resulted in changes in the value of output of extensive arable by 7.104.471 euro which accounts for 2% of the total agricultural gross output. Replacing in equation (3) $\Delta X1$ = 7.104.471 euro, total output generated in the economy is about $\Delta X2$ = 3.023.663 euro. On the other hand, the output of the intensive arable farming system is decreased by 15.135.350 euro and as a result the total output of the local economy is reduced by 8.144.332 euro. In total the net output of regional economy is reduced by 5.120.669 euro. Moreover, the shift from intensive to extensive systems involves agrienvironmental payments to farmers, the impact of which in the local economy is expected to compensate for output losses. However, the I/O approach does not allow the measurement of this compensation, which is possible within a SAM framework.

Further to that it should be mentioned that agriculture beyond its primary function of producing food and fiber commodities, produces jointly a wide range of non-commodity outputs, some of which exhibit the characteristics of public goods or externalities (OECD, 2001). So, changes in land use and farming systems alter not only the levels of commodity outputs, as calculated above, but also the mix of non-commodities generated jointly during the production process. It is widely acknowledged that low-input farming systems are more in 'harmony' with 'natural' ecological processes, contributing positively to the provision of such 'non-market' functions as biodiversity, landscape, water and air quality (Smeding and Joenje, 1999; Kolpin, 1997). In contrast, the intensification of agriculture has detrimental consequences for biodiversity (Robinson & Sutherland 2002), water quality (Sutherland 2002) etc. putting at risk the resilience of ecosystems. As society places an increasing value on the preservation of the environment, the semi-natural habitats and the scenic features of cultivated landscapes contribute positively to regional attractiveness for tourism sector as well as the quality of life. However, it is beyond the scope of this paper to estimate the gains for the regional economy of the non-commodities produced by the extensive agricultural systems and which tend to compensate for the net output losses.

Conclusions

Input-output multiplier analysis shows that the farming system of intensive crops in Trikala creates the strongest backward linkages with the other sectors of economy. Income and employment multipliers are rather low for almost all farming systems with the system of extensive crops having the greatest one, due to high direct income and employment effects they create. Amongst non-agricultural sectors, products of trade and tourism seem to create the greatest backward linkages with the rest economy. The CAP reform and the implementation of the Single Farm Payments have introduced reallocation of land resources from intensive to extensive farming systems and have initiated changes in rural areas. From the above analysis it is derived that the net output generated from the land reallocation is negative for the rural economy. However, the process of land reallocation seems to be at initial stage and it is expected to go on. Considering also that, European policy initiatives aiming at strengthening the viability of rural areas have as central point the multifunctional role of agriculture and stress the importance of safeguarding the provision of agri-environmental goods, it is essential to take into consideration that this land reallocation enhance the generation of such positive externalities from agriculture and must be further investigated in future research.

References

Baumol, J. and Wolff, N., 1994. A key role of Input-Output analysis in policy design. *Regional Science and Urban Economics* 24, pp. 93-114.

Ciobanu, C., Mattas, K. and Psaltopoulos, D., 2004. Structural Changes in Less Developed Areas: An Input–Output Framework. *Regional Studies* 38(6), pp. 603–614.

Czamanski, S. and Malizia, E.E., 1969. *Applicability and limitations in the use of national input-output tables for regional studies*. Regional Science Association Papers and Proceedings 23.

Henry, M. and Schluter, G., 1985. Measuring backward and forward linkages in the US food and fiber system. *Agricultural Economics Research* 37 (4), pp. 33-39.

Jensen, R.C., Mandeville, T.D. and Karunaratne, N.D., 1979. *Regional Economic Planning*. Croom Helm, London.

Johns, P. M. and Leat, P. M. K., 1987. The application of modified GRIT input-output procedures to rural development analysis in Grampian Region. *Journal of Agricultural Economics* 38, pp. 242-256.

Johnson, T. G. and Kulshreshtah, S. N., 1982. Exogenising Agriculture in an Input-Output Model to Estimate Relative Impacts of Different Farm Types. *Western Journal of Agricultural Economics* 9(1), pp. 1-11.

Kolpin, D.W., 1997. Agricultural Chemicals in Groundwater of the Midwestern United States: Relations to Land Use. *Journal of Environmental Quality* 26(4), pp. 1025-1037.

Mattas, K. and Tsakiridou, E., 2010. Shedding fresh light on food industry's role: the recession's aftermath. *Trends in Food Science & Technology* 21, pp. 212-216.

Midmore, P. and Harrison-Mayfield, L., 1996. *Rural Economic Modelling*. An Input-Output Approach. Wallingford: CAB International.

OECD, 1994. *Creating Rural Indicators for shaping territorial policy*. Paris, OECD.

OECD, 2001. *Multifunctionality: Towards and Analytical Framework*. Paris, OECD.

Papadas, C.T. and Dahl, D.C., 1999. Supply-Driven Input-Output Multipliers, *Journal of Agricultural Economics* 50(2), pp. 269-285.

Petkovich, M. D. and Ching, C. T. K., 1978. Modifying a One Region Leontief Input-Output Model to Show Sector Capacity Constraints. *Western Journal of Agricultural Economics* 3, pp. 173-179.

Psaltopoulos, D. and Thomson, K. J., 1993. Input-output evaluation of rural development: a forestry-centred application. *Journal of Rural Studies* 9, pp. 351-358.

Richardson, H., 1972. *Input-Output and Regional Economics*. Weidenfeld and Nicolson, London.

Robinson, R.A. & Sutherland, W.J., 2002. Changes in arable farming and biodiversity in Great Britain. *Journal of Applied Ecology* 39, pp. 157–176.

Smeding, F.W. and Joenje, W., 1999. Farm-nature Plan: landscape ecology based farm planning. *Landscape and Urban Planning* 46 (1-3), pp. 109-115.

Sutherland, W.J., 2002. Restoring a sustainable countryside. *Trends in Ecology and Evolution* 17, pp. 148–150.

Tzouvelekas, V. and Mattas, K., 1999. Tourism and agro-food as a growth stimulus to a rural economy: the Mediterranean island of Crete. *Journal of Applied Input-Output Analysis* 5, pp. 69-81.